NASA TECH BRIEF

Lewis Research Center

DESIGN CRITERIA MONOGRAPH FOR PRESSURIZED METAL CASES

A design criteria monograph has been published which is a summary and a systematic ordering of the large and loosely organized body of existing successful design techniques and practices for solid rocket motor metal cases.

This monograph was written to organize and present, for effective use in design, the significant experience and knowledge accummulated by NASA in development and operational programs. It reviews and assesses current design practices, and from them establishes firm guidance for achieving greater consistency in design, increased reliability in the end product, and greater efficiency in the design effort.

The successful development of metal cases for solid rocket motors presented many problems. Many of the problems encountered are comparable to those that have to be resolved in the fabrication of commercial metal pressure vessels and thus the same techniques may be of value in solving these problems.

Improper use of existing technology sometimes results in cracking or complete rupture of the case in service, or causes unnecessary weight penalties or high costs. Case failures can result from improper design and analysis, underestimation of service conditions, failure to use nondestructive tests at critical phases of fabrication, and improper material and process control, including welding qualification. The case is usually designed to satisfy performance requirements, while an independent, parallel effort is made to assess cost effectiveness and reliability for the specific design. Therefore, in the monograph, emphasis is placed on those areas where specific technical approaches, cost-effectiveness and reliability trade studies, or material and process evaluations and controls should be coordinated to achieve design objectives.

The monograph comprises two major sections: State of the Art, and Design Criteria and Recommended Practices. References complement the text.

The State of the Art section reviews and discusses the total design problem, and identifies the design elements that are involved in successful design. The Design Criteria state clearly and briefly each rule, guide, limitation, or standard that must be imposed on each essential design element to assure successful design; the Recommended Practices set forth the best available procedures for satisfying the Design Criteria.

Both major sections are divided into five subject categories: case configuration (case characteristics as related to the motor and vehicle requirements), material selection (case loading, mode of failure, fatigue, fabrication, configuration, environmental effects), case design (safety factor, end closure, case attachments, case loads, structural analysis, structural dynamics), case fabrication, and inspection and testing (inspection plan, destructive and nondestructive testing, and hydrostatic test). These tasks are considered in the order and manner in which the designer must handle them.

This thorough review of design criteria and practices relating to metal cases should be of value to manufacturers of metal pressure vessels.

NOTES:
1. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)
   Reference: NASA SP-8025 (N70-29740), Solid Rocket Motor Metal Cases
2. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B72-10633

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